We claim:

1. A process of removing heat from an exothermic process, comprising:

conducting an exothermic process in a process channel;

removing heat from the exothermic process in the process channel to an adjacent minichannel or adjacent microchannel;

passing a coolant fluid through the adjacent minichannel or adjacent microchannel that undergoes partial boiling for a length of at least 15 cm as it passes through the adjacent minichannel or adjacent microchannel;

wherein the adjacent minichannel or adjacent microchannel comprises an interior wall surface that is a surface on a channel wall that separates the adjacent minichannel or adjacent microchannel from the process channel; and

wherein the average shear stress of the fluid at the wall in the adjacent minichannel or adjacent microchannel for a length of at least 1 cm, either measured or calculated, is at least 1 Pascals (Pa).

2. The process of claim 1 wherein the adjacent minichannel or adjacent microchannel is a microchannel having a hydraulic diameter of 2 mm or less.

3. The process of claim 2 wherein the average shear stress of the fluid at the wall in the adjacent microchannel for a length of at least 1 cm, is at least 10 Pascals.

4. The process of claim 2 wherein the average shear stress of the fluid at the wall in the adjacent microchannel for the entire length of the adjacent microchannel, is at least 10 Pascals.

5. The process of claim 3 wherein flow through the adjacent microchannel is laminar flow.

6. The process of claim 3 wherein the process channel has a hydraulic diameter of 10 mm or less.

7. The process of claim 1 wherein the adjacent minichannel or adjacent microchannel has a hydraulic diameter of 5 mm or less.

8. The process of claim 2 wherein the coolant fluid enters the adjacent microchannel at a temperature of at least 5° C. less than the boiling temperature at the conditions in the microchannel.

9. The process of claim 6 wherein partial boiling in the adjacent microchannel occurs over a length of at least 50 cm.

10. The process of claim 1 wherein the coolant fluid comprises a surfactant.

11. The process of claim 1 wherein the adjacent microchannel comprises an inlet and an outlet, wherein the microchannel has a larger cross sectional area near the inlet, where the coolant fluid isn't boiling, than in a region further downstream where the coolant fluid is boiling.

12. A process of cooling an exothermic process, comprising:

conducting an exothermic process in a process channel;

providing cooling to the exothermic process in the process channel by transferring heat to an adjacent microchannel having a channel length of at least 25 cm;

passing a coolant fluid at a flow velocity of at least 0.1 m/s through the adjacent microchannel that undergoes partial boiling as it passes through the adjacent microchannel;

wherein the adjacent microchannel comprises an interior wall surface that is a surface on a channel wall that separates the adjacent microchannel from the process channel; and wherein the surface's temperature during the process is no more than 5° C. above the coolant fluid's boiling temperature at conditions present within the microchannel.

13. The process of claim 12 where the exothermic process is selected from the group consisting of: Fischer-Tropsch reaction, alkylation, oxidation to produce an oxygenate or nitrile, dimerization, polymerization, hydrogenation, hydrodesulfurization, hydrotreating, hydrocracking, or direct combination of hydrogen and oxygen to hydrogen peroxide.

14. A process of removing heat from an exothermic process, comprising:

conducting an exothermic process in a process channel;

removing heat from the exothermic process in the process channel to an adjacent minichannel or adjacent microchannel;

passing a coolant fluid through the adjacent minichannel or adjacent microchannel that undergoes partial boiling for a length of at least 15 cm as it passes through the adjacent minichannel or adjacent microchannel;

wherein a channel wall that separates the adjacent minichannel or adjacent microchannel from the process channel; and

where the overage temperature (T_w-T_s) is equal to or less than the following function:

$$56353 \times Bo + 1.4315$$

from $Bo = 1.0 \cdot 10^{-6}$ to $1.0 \cdot 10^{-4}$, for 3 or more adjacent minichannels or adjacent microchannels wherein each channel's length is greater than 15 cm.

15. The method of claim 2 wherein the adjacent microchannel is disposed horizontally with respect to gravity.

16. A process of removing heat from an exothermic process, comprising:

conducting an exothermic process in a process channel;

removing heat from the exothermic process in the process channel to an adjacent minichannel or adjacent microchannel;

passing a coolant fluid through the adjacent minichannel or adjacent microchannel that undergoes partial boiling for a length of at least 15 cm as it passes through the adjacent minichannel or adjacent microchannel;

wherein a channel wall that separates the adjacent minichannel or adjacent microchannel from the process channel; and

wherein at least 50% of the length of the adjacent microchannel, wherein boiling is occurring, is disposed horizontally with respect to gravity.

17. The method of claim 16 wherein flow through the adjacent microchannel is cross flow with respect to flow through the process channel.

18. The method of claim 2 comprising plural coolant microchannels connected to a common manifold, and